

Claims

- [c1] 1. A method for cleaning an EGR cooler of an exhaust gas recirculation system, comprising:
 - utilizing an arrangement in a combustion engine powered vehicle to enable periodic reduction of particulate accumulation in an EGR cooler of an exhaust gas recirculation system of the vehicle;
 - detecting an excessive particulate accumulation condition in the EGR cooler; and
 - causing liquid-state moisture to be introduced in the EGR cooler thereby enabling a reduction of the excessive particulate accumulation from the EGR cooler.
- [c2] 2. The method of claim 1, wherein the step of causing liquid-state moisture to be introduced in the EGR cooler further comprises establishing conditions in the EGR cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler.
- [c3] 3. The method of claim 2, wherein the step of establishing conditions in the EGR cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler further comprises

delivering coolant to the EGR cooler having a sufficiently low temperature to cause condensation to form from moisture contained in the exhaust gases passing through the EGR cooler.

- [c4] 4. The method of claim 2, further comprises:
initiating the step of causing liquid-state moisture to be introduced in the EGR cooler after the step of detecting an excessive particulate accumulation condition in the EGR cooler.
- [c5] 5. The method of claim 2, further comprises:
initiating the step of causing liquid-state moisture to be introduced in the EGR cooler when a coolant temperature is sensed below a predetermined condensation-forming temperature.
- [c6] 6. The method of claim 2, further comprises:
initiating the step of causing liquid-state moisture to be introduced in the EGR cooler on a subsequent start-up of the combustion engine after the detection of an excessive particulate accumulation condition in the EGR cooler.
- [c7] 7. The method of claim 2, further comprises:
initiating the step of causing liquid-state moisture to be introduced in the EGR cooler on an immediately next-

following start-up of the combustion engine after the detection of an excessive particulate accumulation condition in the EGR cooler.

- [c8] 8. The method of claim 2, further comprises:
initiating the step of causing liquid-state moisture to be introduced in the EGR cooler on a subsequent start-up of the combustion engine after the detection of an excessive particulate accumulation condition in the EGR cooler when a coolant temperature is sensed below a predetermined condensation-forming temperature.
- [c9] 9. The method of claim 2, further comprises:
permitting caused condensation to absorb into the excessive particulate accumulation thereby loosening adherence of the excessive particulate accumulation from the EGR cooler.
- [c10] 10. The method of claim 9, further comprises:
flushing the moistened and loosened excessive particulate accumulation from the EGR cooler.
- [c11] 11. The method of claim 10, further comprises:
utilizing exhaust gas pressure to flush the moistened and loosened excessive particulate accumulation from, and downstream of the EGR cooler.
- [c12] 12. The method of claim 2, further comprising:

forming an acid as a consequence of the causation of condensation; and exposing downstream components of the arrangement to the acid.

- [c13] 13. The method of claim 12, further comprising:
minimizing the exposure of the downstream components to the acid.
- [c14] 14. The method of claim 13, wherein the step of minimizing the exposure comprises causing condensation only when an excessive particulate load is detected.
- [c15] 15. The method of claim 13, wherein the step of minimizing the exposure comprises immediately drying condensation from the acid-exposed downstream components thereby rendering the acid less corrosively active.
- [c16] 16. The method of claim 2, further comprising:
utilizing an automated controller as part of the arrangement in a combustion engine powered vehicle to execute a cleaning routine that affects the periodic reduction of particulate accumulation in the EGR cooler of the exhaust gas recirculation system of the vehicle.
- [c17] 17. The method of claim 16, further comprising:
controlling the inlet of exhaust gas to the exhaust gas recirculation system of the vehicle by manipulating an

EGR valve, via the automated controller, based on sensed conditions of the exhaust gas recirculation system.

- [c18] 18. The method of claim 17, further comprising:
sensing at least a temperature of coolant available to supply to the EGR cooler and a temperature after the EGR cooler.
- [c19] 19. The method of claim 2, further comprising:
basing the detection of an excessive particulate accumulation condition in the EGR cooler on a sensed temperature after the EGR cooler exceeding a predetermined high-temperature threshold.
- [c20] 20. The method of claim 19, further comprising:
prescribing the predetermined high-temperature threshold based on heat resistant characteristics of downstream components of the arrangement relative to the EGR cooler.
- [c21] 21. A method for cleaning an EGR cooler of an exhaust gas recirculation system in a vehicle, comprising:
locating, in an exhaust gas recirculation system adapted vehicle, a first temperature sensor after an EGR cooler of the system at a suitable location to detect an exit-temperature of exhaust gas leaving the EGR cooler and a second temperature sensor at a suitable location to de-

tect a temperature of available coolant for the EGR cooler; arranging the first and second temperature sensors in communication with an automated controller adapted to execute a cleaning routine that affects a periodic reduction of particulate accumulation in the EGR cooler; and executing the cleaning routine, responsive to instructions from the automated controller, when the first temperature sensor has detected an over-threshold temperature condition and the second temperature sensor has detected an under-threshold temperature condition.

- [c22] 22. The method of claim 21, further comprising:
causing condensation to form from moisture contained in exhaust gases passing through the EGR cooler thereby enabling a reduction of particulate accumulation from the EGR cooler when the condensation mixes with, and loosens particulate adhering to the EGR cooler.
- [c23] 23. The method of claim 21, wherein said step of executing the cleaning routine further comprises:
opening an EGR valve thereby causing exhaust gas flow into the EGR cooler when conditions in the EGR cooler are sufficient to cause condensation to form from moisture contained in the exhaust gas directed therethrough.
- [c24] 24. A method for cleaning an EGR cooler of an exhaust

gas recirculation system in a vehicle, comprising:
utilizing an arrangement in a combustion engine powered vehicle to enable periodic reduction of particulate accumulation in an EGR cooler of an exhaust gas recirculation system of the vehicle; and
causing liquid-state moisture to be introduced in the EGR cooler thereby enabling a reduction of the excessive particulate accumulation from the EGR cooler.

- [c25] 25. The method of claim 24, wherein the step of causing liquid-state moisture to be introduced in the EGR cooler further comprises establishing conditions in the EGR cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler.
- [c26] 26. The method of claim 25, wherein the step of establishing conditions in the EGR cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler further comprises delivering coolant to the EGR cooler having a sufficiently low temperature to cause condensation to form from moisture contained in the exhaust gases passing through the EGR cooler.
- [c27] 27. The method of claim 25, further comprises:
initiating the step of establishing conditions in the EGR

cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler upon start-up of the vehicle.

- [c28] 28. The method of claim 27, further comprises:
initiating the step of establishing conditions in the EGR cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler upon start-up of the vehicle only when a predetermined vehicle condition has been detected.
- [c29] 29. The method of claim 25, further comprises:
initiating the step of establishing conditions in the EGR cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler upon cold start-ups of the vehicle.
- [c30] 30. The method of claim 29, further comprises:
initiating the step of establishing conditions in the EGR cooler sufficient to cause condensation to form from moisture contained in exhaust gases passing through the EGR cooler upon start-up of the vehicle only when a predetermined vehicle condition has been detected.
- [c31] 31. The method of claim 30, further comprises:
initiating the step of causing liquid-state moisture to be introduced in the EGR cooler when a coolant temperature

is sensed below a predetermined condensation-forming temperature.

- [c32] 32. The method of claim 25, further comprises:
initiating the step of causing liquid-state moisture to be introduced in the EGR cooler on a subsequent start-up of the combustion engine after detection of an excessive particulate accumulation condition in the EGR cooler.
- [c33] 33. The method of claim 25, further comprises:
permitting caused condensation to absorb into the particulate accumulation in the EGR cooler thereby loosening adherence of at least a portion of the particulate accumulation from the EGR cooler.
- [c34] 34. The method of claim 33, further comprises:
flushing at least a portion of the moistened and loosened particulate accumulation from the EGR cooler.
- [c35] 35. The method of claim 34, further comprises:
utilizing exhaust gas pressure to flush the moistened and loosened excessive particulate accumulation from, and downstream of the EGR cooler.
- [c36] 36. The method of claim 25, further comprising:
forming an acid as a consequence of the causation of condensation; and
exposing downstream components of the arrangement

to the acid.

- [c37] 37. The method of claim 36, further comprising:
minimizing the exposure of the downstream components
to the acid.
- [c38] 38. The method of claim 25, further comprising:
utilizing an automated controller as part of the arrangement
in a combustion engine powered vehicle to execute
a cleaning routine that affects the periodic reduction of
particulate accumulation in the EGR cooler of the exhaust
gas recirculation system of the vehicle.
- [c39] 39. The method of claim 38, further comprising:
controlling the inlet of exhaust gas to the exhaust gas
recirculation system of the vehicle by manipulating an
EGR valve, via the automated controller, based on sensed
conditions of the exhaust gas recirculation system.
- [c40] 40. The method of claim 38, further comprising:
sensing at least a temperature of coolant available to
supply to the EGR cooler.
- [c41] 41. The method of claim 38, further comprising:
sensing at least a temperature of the exhaust gases
after the EGR cooler.